A Burn Intensive Care Unit Nurse's Perspective

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For burn patients, the day of surgery can come as quickly as hours or as late as days, possibly even weeks, after the initial injury. With reconstructive and scar revision procedures the patient's surgical journey may not end until years after the burn. It is the first few surgical procedures that concern the burn intensive care unit (BICU) nursing staff the most. After a large burn encompassing 30% total body surface area or greater, the first excision and grafting (E&G) procedures are the most critical. Experienced burn surgeons and BICU staff know that there is no substitute for early, aggressive excision of the burn wound in patients with large burns.

Deep or Full thickness burns produce an inflammatory response where the eschar (the deep cutaneous necrotic tissue produced by thermal burn or corrosive application) and the viable tissue meet. This area is where bacterial growth in the eschar attracts polymorphonuclear leukocytes (neutrophils) that release large amounts of proteolytic enzymes and inflammatory mediators.[1] As a result, these mediators start separating eschar from the granulating tissue that produces nonsurgical burn scars. These untreated burns result in limited mobility and disfiguring scars. By removing the burned and devitalized tissue, burn surgeons are able to save the patient's life as well as improve appearance and function.

Research shows that E&G surgical intervention not only improves survival rates, it decreases the length of hospital stay and decreases the total cost associated with burns.[1] Additionally, it has been shown that mortality decreases even in the presence of inhalational injuries. Early surgical removal of the burn wound and covering of the surgical site with autograft or allograft became the standard of practice in 1976.[1] The presence of a burn wound, partial- or full-thickness, is a constant drain on the patient's reserves; surgical intervention and closure of the burn wound significantly limit this drain.

The main objective in burn care is closure of the wound with the patient's own epidermis. Sometimes closure is spontaneous, but often surgery is required to

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remove the eschar and cover the wound with autologous skin graft or autograft (harvested from the patient). When there is not enough autograft to cover the wound, the gold standard is use of allograft, or cadaver skin, to cover the wound.[1] If fresh skin is available, it may take as a skin transplant until the body rejects it, which may take weeks to months. This temporary covering allows donor sites to heal before they are reharvested.

The burn patient is transported to the operating room (OR) in a manner different from the way other patients go in. The patient is brought in on the specialty bed (Kin Air bed or Fluid Air bed, KCI, San Antonio, TX, USA) that he or she was on in the BICU. A thermoreflective blanket covers the patient to maintain and help prevent any heat loss while moving from the warm environment of the BICU out into the cooler hallway. Hemodynamic monitoring continues throughout the transport process until the patient is connected to the monitors in the OR. All pumps are transported along with his or her vasoactive drugs, and intravenous (IV) fluids are kept running during the transport to the OR and during the procedure. Up to three IV poles with two three-chamber pumps each are transported with the patient. Additional staff are required to help maneuver the bed, the monitors, and the IV poles for a safe and quick trip to the OR.

Respiratory therapists are part of the transport team because the volumetric diffusive respirator ventilator is often used in the OR. The respiratory therapist wears a backpack harness containing a green fiberglass oxygen tank that is connected to the ventilator, which remains connected to the patient during the transport.

The entire OR staff waits, wearing protective gowns, masks, eyewear, and gloves, as the patient is rolled into the room. Once lines are secured the team is ready to move the patient over to the OR table to position, prep, and drape appropriately for the beginning of the E&G procedure.

Positioning the burn patient prone for any part of the surgical procedure has its own set of issues. Whenever the patient is turned onto a prone position for harvesting of grafts or debridement of burns, the potential exists for invasive lines to be dislodged, Foley catheter, trauma, and, most critical, unintentional extubation, which would cause decompensation and require emergent return to the BICU. Additionally, pronating a patient often results in facial and scleral edema, even with the use of special face padding and goggles.

Burn wounds have been classified into three categories: first-, second- and third-degree. The burn community prefers to use the terms *superficial* or *partial-thickness* and *full-thickness* to describe burn injuries. Typically, a first-degree burn is not considered part of the burn wound because it involves only the epidermis and heals quickly with the growth of new keratinocytes.[1] The second-degree, or partial-thickness, burn destroys all of the epidermis as well as portions of the dermis. Some partial-thickness burns heal without surgical intervention if the follicular bulge area is uninjured. It is thought that stem cells originating from the bulge area produce the new keratinocytes that repopulate the epidermal basal cell layer including sebaceous glands and hair follicles within the new epidermis.[1] This burn wound is extremely painful, making cleaning and debridement a horrific procedure for the patient and a stressful daily activity for the burn nurse. Partial-thickness burns that can be left alone are treated with topical antimicrobial agents.

A tangential excision is used on a partial thickness burn by removing thin layers of burned skin until the surgeon reaches viable dermis or the subcutaneous fat is exposed. Several instruments may be used to excise the burn wound including knives with adjustable guards that allow the surgeon to vary the depth of penetration or dermatomes. The Rosenberg knife, Goulian knife, Watson knife, and, VersaJet water

dissector are some examples of tangential excision instruments used in burn procedures. With a tangential excision, healthy tissue is determined by the presence of dermal or subcutaneous bleeding.[2] The burn is debrided to a shiny white dermal surface with fine copious blood flow.

Deep-, or full-thickness, burns involve the entire thickness of the dermis and extend into the subcutaneous fat. If small enough, a full-thickness burn wound will heal as the eschar separates and granulation occurs, but this process leads to hypertrophic scars. Surgical intervention is most likely the only choice in any full-thickness burn injury. This leather-like injury is relativity painless and nonblanching. All other burned areas have pain associated in and around the burn wound. Early E&G decreases the pain associated with the burn wound over time.[2]

Current practice is to excise as much of the burn wound as possible during the initial surgical procedure, taking into account the stability of the patient.[1] The excision of the burn wound can be a tangential excision that removes the burned tissue, leaving as much of the underlying viable tissue as possible. With this type of excision body contours are better preserved, hospital stay is decreased, reconstructive surgical procedures are fewer, and patients report less associated pain.[1]

The fascial excision is a formal integumentectomy excision that removes the subcutaneous fat including the lymphatic tissue down to the fascia. Although less blood loss is expected, this procedure creates what is known as “step-offs.” During a fascial excision, the surrounding viable tissue and underlying fat result in an uneven surface that creates the step-off. Typically, electric cautery can be used to excise the burn wound, decreasing bleeding as the tissue is removed.

Meshed split-thickness autograft gives a less desirable cosmetic appearance but is required when available donor sites are limited or the patient has suffered an extensive burn. The meshed skin is achieved by running the sheet graft through the surgical mesher at a determined ratio of expansion (1:1 through 4:1). The parallel slits created in the sheet graft allow the skin to be expanded when being placed on the excised wound bed. The newly placed meshed autograft will begin to reepithelialize across the interstices connecting the meshed skin to provide wound closure. Time to closure is dependent on the patient and ratio of expansion. When healed, the graft retains the wafflelike meshed appearance, texture, and color. Meshed graft is protected by the surgical dressing for 3 to 5 days, allowing the graft to adhere to the wound bed. Leaving the dressings on for such an extended time allows the fibrin seal that initially holds the autograft in place to advance with capillary growth and collagen production.[2] Allograft may be placed over the larger expanded autograft to protect against shearing. The use of negative-pressure dressings or Wound Vacs (KCI, San Antonio, TX, USA) may also be used to cover and protect the newly placed autograft, keeping the dressing in place for the same 3 to 5 days postoperatively.

Each type of graft placed on the patient has specific implications in the postoperative period for the BICU staff. Split-thickness sheet autograft, or sheet graft, is a continuous layer of donor skin that is harvested from the donor site and secured to the patient with staples, sutures, or adhesive strips. This type of graft is usually reserved for cosmetic areas like the face, neck, hands, and fingers. The thickness of the graft harvested typically is 0.009 to 0.020 inches as determined by the burn surgeon to maximize outcome for the individual patient. The thicker grafts tend to shrink less and provide a better cosmetic appearance.[2] With sheet grafts, typically 12 to 24 hours post graft placement the nurse and surgeon evaluate the graft and remove any blood clots and accumulated serum. The sheet graft must be assessed and evaluated frequently to remove any subgraft hematoma or seroma by needle aspiration or by placing a small incision to roll out fluid or clots. Rolling out the seroma toward the

edge of the graft with a cotton-tip applicator during the first several days can become an hourly task.

Burn patients typically become hypothermic while in the OR despite increased room temperature (85°–95° F) and draping while on the OR table. It is not uncommon for the BICU room temperature to be increased to between 85° and 100° F. Most nurses choose to have the room as warm as possible because they understand that postoperative hypothermia increases the risk of vasoconstriction, hypoperfusion, and metabolic acidosis. Heat lamps and space blankets along with increased room temperature are efficient ways to warm the patient and provide an optimal environment for graft take. Another piece of equipment that should be available is a rapid infuser with heating capabilities. This device allows for a fast delivery of IV fluids for hypovolemic shock and gives the staff another option to reverse the hypothermic state the patient may return in.

For postoperative patients deemed at risk for hemodynamic insufficiency, the US Army Burn Center prepares vasopressin, norepinephrine, and dobutamine prior to the patient's return from surgery. The first drug of choice is vasopressin. In the Army BICU, vasopressin is hung as a first line drug in hemorrhagic shock associated with excessive blood lose related to extensive E&G. Vasopressin acts on the renal system by increasing the water permeability of the distal tubules and collecting ducts, allowing water reabsorption. It also acts on the cardiovascular system by increasing peripheral vascular resistance and in turn increasing the arterial blood pressure. Vasopressin is an on/off drug; there is no need to titrate up or down. The standard dose is 0.04 U/min or 2.4 U/h.

If the patient continues to require cardiovascular support, norepinephrine is the next choice in the bedside arsenal. Norepinephrine acts on both α_1-and α_2-adrenergic receptors, causing vasoconstriction and increased peripheral vascular resistance. At increased doses and when combined with other vasopressors it can lead to limb ischemia. In causing vasoconstriction and limb ischemia, norepinephrine is basically starving the newly placed graft of blood flow and increasing the risk of poor or no graft take and ultimately risking another surgical procedure for the patient to undergo. For this reason norepinephrine is not considered as a first line vasopressor in the Burn ICU. Norepinephrine is hung and titrated up, down, and off very quickly, if possible.

Since Dobutamine is a direct-acting agent whose primary activity results from the stimulation of the β_1-adrenoceptors of the heart which increases contractility and cardiac output, it is of little use immediately postoperatively because the patient often has hypovolemic shock. Once fluid and blood products have restored intravascular volume, dobutamine may be used.

At the Army Burn Center, having two "bricks" at the bedside is a practice used for a large-burn patient returning from the OR. The brick is a consolidation of elements used during a massive transfusion into one bag and is only used in the face of ongoing bleeding and severe hypotension while waiting for blood products. The brick is composed of 100 mL of 25% albumin and 1 A of sodium bicarbonate in 1 L Ringer lactate. If the mean arterial pressure is low ($<$50), the physician may transfuse the patient postoperatively with packed red blood cells, plasma, and/or platelets.

The hypovolemic state brought on by massive blood loss in the OR and possible continued blood loss from open wounds and donor sites continues to assault the patient's hemodynamic stability. At this time, BICU nurses hang the brick while waiting for additional blood products to arrive.

Total fluids infused include colloids, crystalloids, blood products, and hypodermal clysis (subcutaneous fluid instillation). Colloids (albumin and plasma proteins) are

used to increase intravascular volume; crystalloids (lactated Ringer and normal saline) help in the vascular volume but also replace the extracellular fluid. The amount of packed red blood cells given in the burn OR is a good indicator of blood loss and allows the BICU nurse to anticipate the need for more products to have on hand in the BICU.

In the burn OR, hypodermal clysis is a subcutaneous injection of saline into the dermis that allows for easier harvesting over irregular surfaces like the ribs or back. At the Army Burn Center, a solution of 1 L of Ringer lactate with 1 cc of epinephrine 1:100,000 U infused with an 18-gauge spinal needle and a pressure pump is used. This derma-infused solution is eventually absorbed into the patient's vasculature over the course of several hours. Physicians and BICU staff must be made aware of this volume to adjust the IV volume being administered and reduce the risk of fluid overload.

It is impossible to accurately estimate blood loss during burn surgery. During the procedure, blood is not collected in canisters where it can be measured but is under the patient, in surgical drapes, absorbed in sponges and towels, on the floor, and even washed down drains. The estimated blood loss is an art form established over countless surgical procedures and is a well-educated guess by the experienced burn anesthesiologist. Urine output is also a component of fluid loss and should be included in the OR to BICU report.

Donor site care is different from burn wound care; each burn facility has its own way of dressing and managing donor sites. One is Xeroform gauze stapled over the wound, Telfa and epi-laps (sterile burn sponges soaked in a solution of 10 cc epinephrine 1:100,000 U in 1 L sterile normal saline irrigation) then compressed with an elastic bandage. The dressing is removed 24 hours postoperatively. Heat lamps are applied if additional drying is required. Lamps are placed 18 to 24 in above the site for 20 minutes each hour to facilitate drying. A positioning device that elevates the limb and allows air flow around the donor site to aid in drying is effective. Some biological dressings are used, but if fluid accumulates under the dressing it can lead to infection and possible conversion to a full-thickness wound. Infection and possible conversion occurs when a donor site has decreased perfusion and the wound fluid is left to create an overly moist wound bed.

A trip to the burn OR increases the workload of the BICU, but a well-prepared nurse can receive the patient from the OR in any condition and lead the nursing team through a potentially chaotic, intense, and emergent postoperative period.

Burn care requires constant communication and attention to detail; it is a physical form of nursing that requires mental and physical toughness. From the warm environment and long hours at the bedside caring for the patient to the interaction with the families, burn nurses are at the front of patient care. With the proper education and training, those who choose the rewarding title of burn nurse make a difference every day in the lives of their patients and their patients' families.

REFERENCES

1. Herndon DN. Total burn care. 3rd edition. Philadelphia: Elsevier; 2007. Chapters 11, 13, 14, 15.
2. Carrougher GJ. Burn care and therapy. St Louis (MO): Mosby; 1998. Chapter 10.